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NPIC/TSSG/RED-1326-6
13 November 1968

MEMORANDUM FOR: Chief, Technical Services and Support Group, NPIC
THROUGH : Chief, Research & Engineering Division, TSSG
SUBJECT : NPIC Image Enhancement Potential
REFERENCE : APED Memorandum [] Dated 15 September 1968
Re Subject

1. In general the RED components and personnel who are knowledgeable of this subject agree with the basic thrust of the reference which is that (a) NPIC has no significant production-oriented image enhancement capability and (b) APED is a logical component to assume such a function.

2. There is less agreement with some of the details in the attachment to the reference.

a. Ref. Attachment, Para II.2. The function described here appears to duplicate the RED function in that it states APED "has the responsibility . . . to investigate, develop and implement advanced techniques for analyzing and interpreting degraded imagery." In order to be consistent with the rest of the APED paper and the established understanding of the mission and functions of the TSSG divisions this statement should be modified. The responsibility for investigating and developing such advanced techniques clearly belongs to the Research and Engineering Division. Upon discussing this matter with [] of APED, it was determined that the statement in the reference concerning APED responsibility . . . was the paraphrase compiled by him. After reviewing the mission and function statements held by FTS dated August 1968, it was determined that no such conflict existed with the functions stated for APED in that document.

b. Image Enhancement. Before continuing with a detailed analysis of the APED paper a brief discussion of the subject of Image Enhancement is necessary.

It may not be apparent under present circumstances, but it is typical and appropriate for the scientists and engineers involved in a new development to be cautious about its utilization until it has been adequately evaluated. So it is with RED and various "image enhancement" developments.

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Before we can consistently enhance images, we need to know the various properties of the image that contribute to its perceptibility, the degree of significance of each and the interrelationships between these properties. In most of the so-called "image enhancement" techniques known today some properties are improved at the expense of others--almost always resulting in a net loss of information. Accordingly, we are concerned about the utility of many of the so-called "image enhancement" techniques.

The entire imagery exploitation community including EPIC is still looking for a system to define and evaluate the properties of images that make them more perceptible and/or interpretable. In short, to our knowledge, there are no established criteria for "enhancing" imagery that will improve its interpretability--apart from the utilization of the best techniques available for high-fidelity duplication of the information captured in the original negative. In fact, most of the so-called "enhancement" techniques have been shown to result in a net loss of information.

To be sure, there is hope of improving the interpretability of an image which has been degraded by any one or a combination of several factors. This, of course, is the objective of the RED Image Manipulation Program, but these techniques are certainly not available for routine operational utilization at this time. Appropriate RED personnel would be glad to brief APED on the extent, objectives, and status of this program in order to insure full coordination and maximum capability for the APED production-oriented effort.

c. Ref Attachment, Para II 8. and 9. The status of the techniques and facilities cited in both these paragraphs is such that only special high-priority experimental jobs can be attempted. They are not suited to routine production of "enhanced" imagery.

3. Discussion. The following remarks will be addressed to matters cited in Section III, Discussion, in the reference attachment.

a. (III 3) The need for a (routine) production capability in image enhancement support is valid. APED is certainly an appropriate component to furnish the leadership for providing this service. However, we would caution against accepting responsibility to augment the ☐ Westover reproduction function in a way that would relieve them of the responsibility for maintaining high-fidelity reproduction standards and rigorous quality control--in other words we recommend that these image enhancement services be limited to cases which are not feasible for the ☐ Westover reproduction capability. It also appears that the PSC/ED/PSE should be brought

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to a level of capability whereby it would be able to perform the more routine services of this type, such as contrast modifications, density cuts, and lagatron prints.

b. (III.5.). We are not aware of any image enhancement techniques that are available for production services which will provide as much information from a 2nd or 3rd generation dupo negative as will be obtained from the careful high-quality duping from the OM without any enhancement.

c. (III.6.). This paragraph should be viewed in the light of our present limited knowledge of what actually achieves a net improvement in the interpretability of imagery and a more careful assessment of when such enhancement is economically feasible and operationally significant.

d. (III.10.). The plan for AFSD to produce a handbook is excellent, but such a handbook should be carefully edited so as not to unintentionally imply "improvements" to the imagery that may actually reduce the information contained in it. Many enhancement techniques are displayed on low resolution imagery in such a way that this information loss is not apparent.

4. Recommendations. The following remarks will be addressed to Section IV, Recommendations, in the reference attachment

a. (IV a.). Generally concur. Suggest changing to, Management designate AFSD to be responsible for providing leadership and coordination for production-oriented imagery enhancement required to support EPIC exploitation operations.

b. (IV b.). Defer until local coordination is achieved.

c. (IV c.). This should be done as a joint activity in coordination with the HED CCE observer with appropriate correlation to our HED program in this area.

d. (IV d.). Much work remains to be done in this area. Definition of the image perceptibility characteristics is the most significant missing foundation data. The justification of the cost of such an extensive HED program may be difficult.

e. (IV e & f). HED/ATB/EL will be glad to provide laboratory assistance and to work together with AFSD personnel in this effort when feasible, but this is obviously not a practical arrangement for general production oriented activity.

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5. RED would again like to express its support for the general proposal made by APSD in the reference--with the cautions noted above. Within the general limits we have cited, we stand ready to cooperate with APSD in establishing a first-rate production-oriented imagery enhancement capability at NPIC.

6. Preparation of this memorandum has been coordinated with Messrs. [redacted] RED and Messrs. [redacted]

Special Assistant for Plans & Applications, RED

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